Claims:

1. A strain applicator for applying longitudinal strain of adjustable magnitude to a length of optical fibre, the strain applicator being adapted for mechanical coupling to the length of fibre and comprising first and second actuators coupled such that the magnitude of the longitudinal strain applied to the length of fibre when mechanically coupled to the strain applicator is dependent on their combined effects, the first and second actuators being independently controllable by respective control signals to adjust the magnitude of said applied strain and being selected to provide different actuation characteristics for adjusting said magnitude.

2. A strain applicator in accordance with claim 1, wherein the different actuation characteristics complement each other.

3. A strain applicator in accordance with claim 1, wherein the actuation characteristics of the first and second actuators differ in at least one of the following respects:

the first and second actuators have first and second response times respectively to said control signals, the second response time being faster than the first;

the first and second actuators provide coarse and fine, or fine and coarse adjustment, respectively, of said magnitude;

the first and second actuators provide adjustment of said magnitude over different respective ranges;

the first and second actuators provide adjustment to said magnitude with different respective accuracies.

4. A strain applicator in accordance with claim 1 wherein the second actuator comprises a body of electrostrictive material and at least two spaced electrodes coupled to the body to permit application of a control voltage to the body, the body having a dimension which is dependent on the applied control voltage, and the second actuator is arranged such that the strain applied to the length of fibre is dependent on said dimension.

5. A strain applicator in accordance with claim 4, wherein the body of electrostrictive material comprises a piezoelectric crystal.

6. A strain applicator in accordance with claim 4, comprising a rigid frame and a fibre retainer for holding an end of the length of fibre, wherein the body of electrostrictive material is arranged between the frame and retainer such that variations in said dimension result in corresponding movement of the retainer relative to the frame.

7. A strain applicator in accordance with claim 1, wherein the first actuator is an electro-mechanical actuator.

8. A strain applicator in accordance with claim 7, comprising a rigid frame, a fibre retainer for holding an end of the length of fibre, and at least one leaf spring

coupling the retainer to the frame, the first actuator being arranged to deflect the retainer relative to the frame.

9. A strain applicator in accordance with claim 1, wherein the first actuator comprises:

a body having a dimension which is dependent on the temperature of the body; and a heater controllable to adjust the temperature of the body to adjust said dimension, the first actuator being arranged such that the strain applied to the length of fibre is dependent on said dimension.

10. A strain applicator in accordance with claim 9 wherein said body is metallic.

11. A strain applicator in accordance with claim 10, wherein said metallic body is an aluminium channel having a groove for accommodating the length of optical fibre, and said second actuator comprises a body of electrostrictive material and spaced electrodes coupled to the body to permit application of a control voltage, the strain applicator comprising first and second fibre retainers for holding first and second ends respectively of the length of fibre, the first retainer abutting a first end of the aluminium channel, and the electrostrictive body being arranged between a second end of the channel and the second retainer such that a variation in the control voltage produces a corresponding movement of the second retainer relative to said second end.

12. A strain applicator in accordance with claim 11, wherein said heater is a strip heater arranged in thermal

contact with said channel and extending in a direction parallel to said groove.

13. A strain applicator in accordance with claim 1, wherein said first and second actuators each provide respective ranges of movement and are arranged in mechanical series such that in combination they provide a range of movement corresponding to the sum of said respective ranges.

14. A strain applicator in accordance with claim 1, wherein said first and second actuators individually provide first and second ranges of movement respectively, said first range being longer than the second.

15. A method of applying longitudinal strain of adjustable magnitude to a length of optical fibre, the method comprising the steps of:

mechanically coupling the length of fibre to a combination of first and second actuators, the first and second actuators being independently controllable by respective control signals and being selected to provide different actuation characteristics;

controlling the first actuator with a first control signal to apply a first adjustable component of longitudinal strain to the length of fibre; and

controlling the second actuator with a second control signal to apply an additional adjustable component of longitudinal strain to the length of fibre.

16. A method in accordance with claim 15, wherein the different actuation characteristics complement each other.

17. A method in accordance with claim 15, wherein the first and second actuators have first and second response times respectively to said control signals, the second response time being faster than the first.

18. A method in accordance with claim 15, wherein said second actuator comprises a body of electrostrictive material and said step of controlling the second actuator comprises applying a control voltage to the body to control a dimension of the body.

19. A method in accordance with claim 15, wherein said first actuator comprises a body having a dimension which is dependent on the temperature of the body, and the step of controlling the first actuator comprises the step of controlling the temperature of the body.

20. A method of applying longitudinal strain of adjustable magnitude to a length of optical fibre, the method comprising the steps of: applying longitudinal strain to the length of fibre using a combination of first and second actuators selected to provide different actuation characteristics;

controlling the first actuator with a first control signal; and

controlling the second actuator with a second control signal.

21. An adjustable optical filter comprising: a length of optical fibre adapted to receive an optical signal, the

length of fibre comprising a Bragg reflection grating arranged to provide a reflectance spectrum to said optical signal;

and a strain applicator in accordance with claim 1 mechanically coupled to the length of fibre to apply adjustable longitudinal strain to the Bragg reflection grating to adjust said reflectance spectrum.

22. An adjustable optical filter in accordance with claim 21, wherein said Bragg reflection grating is chirped.

23. An adjustable optical filter in accordance with claim 21, further comprising a controller arranged to provide said control signals to the first and second actuators, the controller being further arranged to control the second actuator to dither the strain applied to the Bragg reflection grating.

24. An adjustable optical filter in accordance with claim 23, wherein said reflectance spectrum comprises a central peak.

25. An adjustable optical filter in accordance with claim 21, wherein the second actuator comprises a body of electrostrictive material.

26. A method of adjustably filtering an optical signal, the method comprising the steps of:

introducing the signal to a length of optical fibre comprising a Bragg reflection grating arranged to provide a reflectance spectrum to the signal;

applying longitudinal strain of adjustable magnitude to the Bragg reflection grating, using a method in accordance with claim 20, to adjust said reflectance spectrum.

27. A method in accordance with claim 26, comprising the step of controlling the second actuator to dither the strain applied to the Bragg reflection grating so as to dither the reflectance spectrum.

28. A device exhibiting adjustable optical dispersion, the device comprising:

a length of optical fibre adapted to receive an optical signal, the length of fibre comprising a Bragg reflection grating arranged to provide a reflectance spectrum to the optical signal; and

a strain applicator in accordance with claim 1 mechanically coupled to the length of fibre to apply adjustable longitudinal strain to the Bragg reflection grating to adjust said reflectance spectrum.

29. A device in accordance with claim 28, wherein said Bragg reflection grating is chirped.

30. A device in accordance with claim 28, further comprising a controller arranged to provide said control signals to the first and second actuators, the controller being further arranged to control the second actuator to dither the strain applied to the Bragg reflection grating.

31. A device in accordance with claim 28 wherein the second actuator comprises a body of electrostrictive material.

32. A device in accordance with claim 28 further comprising a dispersion detector arranged to generate a dispersion signal indicative of the dispersion exhibited by an optical path along which the received signal has been transmitted and a controller arranged to receive the dispersion signal and to provide said control signals to the first and second actuators, the controller being arranged to determine said control signals according to the dispersion signal such that the adjustable optical dispersion provided by the device compensates at least partially for said dispersion exhibited by the optical path.

33. A device exhibiting linear dispersion of adjustable magnitude, the device including first and second lengths of optical fibre provided respectively with first and second chirped Bragg reflection gratings, and being arranged to define an optical transmission path that includes reflection in both gratings, wherein each of the first and second lengths of fibre is mechanically coupled to a respective strain applicator in accordance with claim 1, the strain applicators being controllable to adjust the reflectance spectra of the gratings.

34. A device in accordance with claim 33, further comprising a controller arranged to control said strain applicators such that said reflectance spectra overlap.

35. A device in accordance with claim 33, wherein the controller is arranged to dither the strains applied to the

gratings in phase with each other, to dither the position of the overlap.

36. A device in accordance with claim 34 wherein the controller is arranged to dither the strains applied to the gratings in anti-phase to dither the magnitude of the linear dispersion exhibited by the device.

37. A device in accordance with claim 35 wherein the controller is arranged to dither the strains applied to the gratings in anti-phase to dither the magnitude of the linear dispersion exhibited by the device.

38. A device in accordance with claim 35, wherein each grating is arranged to provide a reflectance spectrum having a peak.

39. A device exhibiting linear dispersion of adjustable magnitude, the device including first and second lengths of optical fibre provided respectively with first and second chirped Bragg reflection gratings, and being arranged to define an optical transmission path that includes reflection in both gratings, wherein each of the first and second lengths of fibre is mechanically coupled to a respective strain applicator, the strain applicators being controllable to adjust the reflectance spectra of the gratings, the device further comprising a controller arranged to control the strain applicators such that the reflectance spectra overlap and to dither the strains applied to the gratings in phase with each other to dither the position of the overlap.

40. A device in accordance with claim 39, wherein the controller is further arranged to dither said strains in anti-phase to dither the amount of overlap.

41. A device exhibiting linear dispersion of adjustable magnitude, the device including first and second lengths of optical fibre provided respectively with first and second chirped Bragg reflection gratings, and being arranged to define an optical transmission path that includes reflection in both gratings, wherein each of the first and second lengths of fibre is mechanically coupled to a respective strain applicator, the strain applicators being controllable to adjust the reflectance spectra of the gratings, the device further comprising a controller arranged to control the strain applicators such that the reflectance spectra overlap and to dither the strains applied to the gratings in anti-phase to dither the amount of overlap.

42. A device in accordance with claim 39 wherein said gratings are adapted to provide reflectance spectra each having a central peak.

43. A device in accordance with claim 40 wherein said gratings are adapted to provide reflectance spectra each having a central peak.

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44. A method of generating a dispersion signal indicative of the dispersion exhibited by an optical path along which an optical signal has been transmitted, the optical signal having been generated by a method comprising the modulation of an optical carrier with an RF data signal having

frequency components across an RF data spectrum such that data is carried by the optical signal in upper and lower sidebands on either side of an optical carrier frequency, the method comprising the steps of:

receiving the optical signal;

deriving an RF signal having a narrow bandwidth within the RF data spectrum from corresponding optical frequencies in the upper and lower sidebands of the received optical signal;

detecting the power of the derived RF signal;

using the detected power as, or to generate, the dispersion signal.

45. A method in accordance with claim 44 comprising the steps of:

deriving a plurality of said RF signals, each having a respective narrow bandwidth within the RF data spectrum, from respective corresponding optical frequencies in the upper and lower sidebands of the received optical signal;

detecting a respective power of each derived RF signal; and

using the detected powers to generate the dispersion signal.

46. A method in accordance with claim 45, wherein said step of deriving a plurality of said RF signals comprises deriving first, second, and third RF signals having bandwidths centred on relative frequencies f, $\sqrt{2}$ f, and 2f respectively.

47. A method in accordance with claim 44 further comprising the step of optically filtering the received optical signal, before deriving the RF signal, to remove optical frequencies outside the upper and lower sidebands.

48. A method in accordance with claim 47, wherein the optical signal has been generated by a method comprising the modulation of the optical carrier with a clock signal, and the step of optically filtering comprises the removal of optical frequencies arising from said modulation with the clock signal.

49. A method in accordance with claim 44, further comprising the step of:

tapping off a portion of the received signal, and wherein the RF signal is derived from the tapped portion.

50. A method in accordance with claim 44, wherein the step of deriving the RF signal comprises:

supplying at least a portion of the received optical signal to a photodiode, and

filtering a signal generated by the photodiode with a narrowband RF filter.

51. A method of compensating for dispersion exhibited by an optical path along which an optical signal has been transmitted, the optical signal having been generated by a method comprising the modulation of an optical carrier with an RF data signal having frequency components across an RF spectrum, such that data is carried by the optical signal in

upper and lower sidebands on either side of an optical carrier frequency, the method comprising the steps of:

generating a dispersion signal in accordance with the method of claim 44;

supplying at least a portion of the received optical signal to a device exhibiting adjustable dispersion;

using said dispersion signal to control the adjustable dispersion device to exhibit dispersion which at least partially compensates for the dispersion exhibited by said optical path.

52. A method in accordance with claim 51, wherein the step of generating the dispersion signal comprises:

tapping off a portion of the received signal before it is supplied to the adjustable dispersion device, and the RF signal is derived from the tapped portion.

53. A method in accordance with claim 51, wherein the received signal is first supplied to the adjustable dispersion device and emerges from said device exhibiting the combined effects of the dispersion exhibited by the optical path and the device, and the step of generating the dispersion signal comprises:

tapping off a portion of the received signal emerging from the adjustable dispersion device, and deriving the RF signal from the tapped portion.

54. A method in accordance with claim 53, further comprising the step of dithering the dispersion exhibited by the adjustable dispersion device.

55. A method in accordance with claim 54, comprising the step of using the dispersion signal in a feedback arrangement to control the adjustable dispersion device to compensate for changes in the dispersion exhibited by said optical path.

56. A method in accordance with claim 55, comprising the step of using a lock-in amplifier to detect the magnitude of a change in detected RF power at the dither frequency.

57. Apparatus for generating a dispersion signal indicative of the dispersion exhibited by an optical path along which an optical signal has been transmitted, the optical signal having been generated by a method comprising the modulation of an optical carrier with an RF data signal having frequency components across an RF data spectrum, such that data is carried by the optical signal in upper and lower sidebands on either side of an optical carrier frequency, the apparatus comprising:

a photodetector arranged to detect at least a portion of the received optical signal and output a corresponding electrical signal;

at least one narrowband RF filter arranged to filter the electrical signal from the photodetector, the or each filter having a passband within said RF data spectrum;

at least one RF detector, the or each detector being arranged to detect the filtered signal from the or a respective one of said filters and to produce a corresponding power signal indicative of the power of the detected filtered signal.

58. Apparatus in accordance with claim 57, wherein the photodetector is a photodiode.

59. Apparatus in accordance with claim 57, comprising three said RF filters having passbands centred on relative frequencies f, √2 f, and 2f respectively.

60. Apparatus in accordance with claim 57, further comprising an optical filter arranged to filter the received optical signal before detection by the photodiode to remove optical frequencies outside the upper and lower sidebands.

61. An adjustable dispersion compensator comprising:

a module exhibiting adjustable dispersion and arranged to receive an optical data signal of the type defined in claim 57;

dispersion signal generating apparatus in accordance with claim 57, and

a controller arranged to control said module according to the power signal or signals to adjust the dispersion exhibited by the module to compensate at lest partially for the dispersion of the optical path to the compensator.

62. An adjustable dispersion compensator in accordance with claim 61 comprising a tap arranged before the adjustable dispersion module to tap off a portion of the optical signal received by the compensator, and wherein the photodetector is arranged to detect the tapped portion.

63. An adjustable dispersion compensator in accordance with claim 61 comprising a tap arranged to tap off a portion of

the received optical signal emerging from the adjustable dispersion module, and wherein the photodetector is arranged to detect the tapped portion.

64. An adjustable dispersion compensator in accordance with claim 63 wherein the controller is arranged to dither the dispersion exhibited by the adjustable dispersion module.

65. An adjustable dispersion compensator in accordance with claim 64, comprising a feedback loop to track changes in the dispersion of the optical path to the compensator.

66. A device exhibiting adjustable reflectance characteristics to optical signals, the device comprising:

a length of optical fibre adapted to receive an optical signal, the length of fibre comprising a Bragg reflection grating arranged to provide a reflectance spectrum to said optical signals;

a strain applicator mechanically coupled to the length of fibre to apply adjustable longitudinal strain to the Bragg reflection grating to adjust said reflectance spectrum; and

a controller arranged to control the strain applicator to dither the applied strain.

67. A device in accordance with claim 66, the device being: an adjustable filter; an adjustable dispersion device; or an adjustable dispersion compensator.

68. A method of providing adjustable reflectance to an optical signal, the method comprising the steps of:

introducing the signal to a length of optical fibre comprising a Bragg reflection grating arranged to provide a reflectance spectrum to the signal;

applying longitudinal strain of adjustable magnitude to the Bragg reflection grating to adjust said reflectance spectrum; and

dithering the strain applied to the Bragg reflection grating so as to dither the reflectance spectrum.

69. A method of adjustably filtering an optical signal, comprising the method of claim 68.

70. A method of providing adjustable dispersion to an optical signal, comprising the method of claim 68, and wherein the grating is chirped.